Claim Rejections

Claims 1,2 and 4 were rejected on obviousness over Lemaire. Examiner contends that one of ordinary skill in the art would have known both to pass a light ray through the fiber and to monitor the exit rays to know when to stop the radiation. Lemaire did not disclose either action. Applicant agrees that passing a light ray through the fiber is an act which would be obvious. But the combination of that and monitoring the light ray while adjusting radiation is not readily apparent and would not be obvious to one of normal skill in the art. Applicant contends that the invention of Lemaire becomes substantially more viable and economically valuable with the application of this less expensive manner of producing couplings, and had it been obvious application to Lemaire should be present in the literature and prior art.

Claim 3 is rejected as unpatentable over Lemaire in light of Emkey. Emkey discloses the fusing of a single mode fiber to a multi-mode fiber, which Lemaire does not. However, to couple the single mode fiber to the multi-mode fiber and achieve beam collimation is difficult, expensive and time-consuming without applicant's invention. Thus again it is the application of radiation while monitoring beam collimation to provide useable coupling which is significant, and would not be obvious to one of normal skill in the art.

Claim 5 and 6 are rejected as unpatentable over Lemaire in view of Emkey and Cullen. Because of slight differences in individual fibers and beam propagation sources, the cutting of the coupler to B(n + 0.5) on a consistent and accurate basis is not easily accomplished. Applicants invention provides a reproducible, inexpensive means of attaining beam collimation without requisite analysis of every new batch of fibers and bean sources, and is there fore not obvious to one of normal skill in the art. The means of achieving coupling involving stripping the cladding and fusing are not the critical elements of claim 5 and 6, it is the passing of radiation while monitoring beam collimation output.

Applicant contends that this combination of passing a light ray through a fiber and monitoring it for beam collimation while adjusting refractive index via radiation requires a combination of several steps which, taken individually, may seem non-obvious, but taken together and in proper sequence are non-obvious and patentably distinct from the prior art.

The cladding is the first layer around the core. The cladding acts to create an optical waveguide which confines the light. The cladding must have an index of refraction which is lower than the core. The cladding is typically composed of pure silica.

The jacket is a non-optical layer disposed around the cladding. Typically a polymer layer, the jacket acts top protect the silica-based core and cladding from exposure to and damage from the outside environment.

Optical fibers are generally classified as single-mode fibers (SMF) or multi-mode fibers (MMF). Modes are mathematical solutions to the electromagnetic wave equation that describes the wave nature of light as it propagates along the optical fiber. The number of solutions equals the number of allowable modes in the fiber. The number is dependant on the diameter and refractive index of the core and the wavelength of the light. The solutions consist of eigen values and eigen functions. The eigen values describe the propagation velocity of the mode. The eigen function describes the physical shape of the mode transverse to the axis of propagation. Therefore, each mode in a fiber has a unique shape and velocity.

A less rigorous approach to characterizing the propagation in optical fiber is to describe the modes using a ray trace model. This model uses the paths by which light rays travel through the fiber. Rays are deflected from the core/cladding interface, bending back toward the axis of the fiber by total internal reflection. The ray deflection and length give a rough approximation of the distribution and relative velocity of the mode.

In a single-mode fiber (SMF), only the fundamental mode is propagated. The fundamental mode travels through the fiber without reflection at the core/cladding